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Filed : March 31, 2004

REMARKS

The October 13, 2006 Office Action was based upon pending Claims 1-74. Claims 6, 17, 18, 24, 26, 31-41, 44-46 and 51-74 were previously withdrawn in response to a restriction requirement. This Amendment amends Claims 1, 9, and 42. After entry of this Amendment, Claims 1-74 remain pending.

Claim Rejections

In the October 13, 2006 Office Action, the Examiner rejected Claims 1-5 and 7-9 under 35 U.S.C. §102(e) as being anticipated by Price, et al (U.S. Patent No. 6,813,429).

The Office Action states that Price discloses a pulsed fiber laser system comprising: a mode-locked fiber oscillator, an amplifier, a variable attenuator, and a compressor. The Office Action further states that the amplifier is configured such that attenuating the optical energy coupled from the mode-locked fiber oscillator to the amplifier reduces the pulse width. The Office Action states in particular that the grating performs the function of attenuating the optical pulses and reducing the pulsed width.

To clarify, Applicants have amended Claim 1 to recite that the variable attenuator has an adjustable transmission such that the optical amplitude of the optical pulses that are coupled from the mode-locked fiber to the amplifier can be reduced. Claim 1 is further amended to recite that the amplifier is configured such that attenuating the amplitude of the optical pulses coupled from mode-locked fiber oscillator to the amplifier reduces the pulse width. Applicants maintain that Price fails to disclose that attenuating the amplitude of the optical pulses coupled from the mode-locked fiber oscillator to the amplifier reduces the pulsed width.

Similarly, Claim 9 has been amended to recite selectively attenuating the amplitude of the laser pulse prior to amplifying of the laser pulse to further shorten the duration of the compressed laser pulses. Applicants maintain that Price fails to disclose selectively attenuating the amplitude of the laser pulse prior to amplifying of the laser pulse to further shorten the duration of the compressed laser pulses.

Applicants maintain therefore that Claims 1 and 9, as well as, Claims 2-5, 7, and 8, which depend therefrom, are not anticipated by Price for at least the reasons given above.

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Further, Claims 10-16, 19-23, 25, and 27-30 are rejected under 35 U.S.C. §103(a) as being unpatentable over Price.

As described above, Claim 9 is patentable over Price. Claims 10 and 11 depend from Claim 9 and, thus, Claims 10 and 11 include all of the features of Claim 9. Accordingly, the combination of claim limitations recited in Claims 10 and 11 are not taught or suggested by the cited reference for at least the reasons described above with regard to Claim 9. Applicants, therefore, respectfully request that Claims 10 and 11 be allowed.

With regard to Claim 12, the Office Action that states Price teaches mode-locking a fiber-based oscillator that outputs optical pulses, optically coupling an amplifier to the fiber-based oscillator through a variable attenuator, including measurement of the optical pulse characteristics, and controlling the pulses. The Office Action states, however, that Price does not teach adjusting the variable attenuator to reduce the intensity of the pulses delivered to the amplifier. The Office Action concludes, nevertheless, that it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the stated pulse controls with an additional attenuator control in order to add a further refinement capability to the system allowing for even greater output pulse modulation.

Applicants respectfully disagree. Attenuation is the opposite of amplification. Applicants submit that attenuating a pulse prior to amplifying the pulse is counterintuitive. One skilled in the art would not be inclined to measure the optical pulses and reduce the intensity of the pulses with a variable attenuator if increasing or amplification of the pulses desired. Applicants further submit that it is not obvious that reducing the intensity of the optical pulses shortens the pulses. Thus, "adjusting said variable attenuator based on a measurement of said optical pulses to reduce the intensity of the optical pulses delivered to said amplifier and shorten said pulse" as recited in Claim 12 is non-obvious. Applicants, therefore, respectfully request that the rejection of Claim 12 be withdrawn.

Claims 13 and 14 depend from Claim 12 and, thus, Claims 13 and 14 include all of the features of Claim 12. As described above, Claim 12 is patentable over Price. Accordingly, the combination of claim limitations recited in Claims 13 and 14 are not taught or suggested by the cited reference for at least the reasons described above with regard to Claim 12. Applicants, therefore, respectfully request that Claims 13 and 14 be allowed.

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With regard to Claims 19-21 and 23, the Office Action states that Price teaches a pulsed fiber laser comprising: a mode-locked fiber oscillator producing an optical output comprising a plurality of optical pulses having a pulse width and a spectral power distribution having a bandwidth, an amplifier optically connected to the mode-locked fiber amplifier, and a grating disposed to receive the optical output of the mode-locked fiber oscillator prior to reaching the amplifier. The Office Action states, however, that Price does not teach the grating to act as a filter to reduce the spectral bandwidth. The Office Action concludes, nevertheless, that it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the compression gratings as a filter in order to allow for transmission of only a specific frequency range, filtering out unwanted frequencies and reducing the spectral bandwidth.

Applicants again respectfully disagree. One skilled in the art would not expect that reducing spectral bandwidth would decrease the temporal pulse width, as reduction in spectral bandwidth is generally associated with an increase in temporal pulse width. Accordingly, it is counterintuitive to include a spectral filter that uses the spectral bandwidth to reduce the pulse width of the optical pulses. Likewise, one skilled in the art would not utilize a compression grating as a filter in order to allow for transmission of only a specific frequency range, filtering out unwanted frequencies and reducing the spectral bandwidth if reduced pulse width is to be obtained. Accordingly, Applicants submit that it is not obvious to include a spectral filter as recited in Claim 19 to reduce the pulse width of the pulses. Accordingly, the limitations recited in Claim 19 as well as those of Claims 20, 21, and 20, which depend therefrom, are not obvious. Applicants, therefore, respectfully request that the rejection of Claim 19-21 and 23 be withdrawn.

Claims 22 and 25 depend from Claim 19 and, thus, Claims 22 and 25 include all of the features of Claim 19. As described above, Claim 19 is patentable over Price. Accordingly, the combination of claim limitations recited in Claims 22 and 25 are not taught or suggested by the cited reference for at least the reasons described above with regard to Claim 19. Applicants, therefore, respectfully request that Claims 22 and 25 be allowed.

With respect to Claim 27, the Office Action states that Price discloses a method of producing compressed optical pulses comprising: substantially mode-locking longitudinal modes of a fiber resonant cavity so as to produce a train of optical pulses having a corresponding spectral power distribution with a spectral bandwidth, amplifying the optical pulses, and

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compressing the optical pulses to produce compressed optical pulses. The Office Action states, however, that Price does not teach the grating to act as a filter to reduce the spectral bandwidth. The Office Action concludes, nevertheless, that it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize the compression gratings as a filter in order to allow for transmission of only a specific frequency range, filtering out unwanted frequencies and reducing the spectral bandwidth.

Applicants respectfully disagree for similar reasons as presented above with regard to Claim 19. In particular, one skilled in the art would not expect that reducing spectral bandwidth would decrease the temporal pulse width, as reducing spectral bandwidth is generally associated with increasing temporal pulse width. Accordingly, it is counterintuitive to reduce the spectral bandwidth to shorten the temporal duration of the pulses. Thus, one skilled in the art would not utilize a compression grating as a filter in order to allow for transmission of only a specific frequency range, filtering out unwanted frequencies and reducing the spectral bandwidth if compressed optical pulses having a shorter duration are to be obtained. Applicants submit that it is not obvious to reduce the spectral bandwidth of the spectral power distribution such that compressed optical pulses have a shorter duration as recited in Claim 27. Accordingly, the limitations recited in Claim 27 are not obvious. Applicants, therefore, respectfully request that the rejection of Claim 27 be withdrawn.

Claims 28-30 depend from Claim 27 and, thus, Claims 28-30 include all of the features of Claim 27. As described above, Claim 27 is patentable over Price. Accordingly, the combination of claim limitations recited in Claims 28-30 are not taught or suggested by the cited reference for at least the reasons described above with regard to Claim 27. Applicants, therefore, respectfully request that Claims 28-30 be allowed.

Claims 42, 43, 49, and 50 are rejected under 35 U.S.C. §103(a) as being unpatentable over Price in view of Horvath, et al. (U.S. Patent No. 6,693,927). Additionally, Claims 47-48 are rejected under 35 U.S.C. §103(a) as being unpatentable over Price in view of Horvath, and further in view of Hu, et al. (U.S. Patent No. 6,901,085).

With regard to Claims 42, 43, 49, and 50, the Office Action states that Price teaches the laser device outlined in the rejection to Claim 1, as well as the rearrangement of the compressor and the amplifier, and the importance of pump radiation power in regards to pulse characteristics.

The Office Action states, however, that Price does not teach (i) an optical tap between the mode-locked fiber oscillator and the fiber amplifier, including a feedback loop from the tap to control fiber oscillator based on a measurement from the tap, or (ii) a second optical tap between the amplifier and the compressor, including a feedback loop from the second tap to control the amplifier based on a measurement from the second tap. The Office Action further states that Horvath teaches a laser system employing mode-locking wherein an optical tap is used after both of the amplifier and oscillator portions to measure the output and make adjustments to the pumping source. The Office Action concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to combine the pump control teaching of Price with the pump control feedback loop of Horvath to either the amplifier or oscillator pumps (i.e., placing a feedback loop after the oscillator back to the oscillator pump, or after the amplifier back to the amplifier pump) to allow for active control of the output pulse characteristics.

Applicants point out that Claim 42 has been amended to recite both

(i) a first optical tap in the optical path between the modelocked fiber oscillator and the fiber amplifier, and

a first feedback loop from the first tap to control the modelocked fiber oscillator based on measurement of output from the first optical tap, and

(ii) a second optical tap in the optical path between the fiber amplifier and the compressor, and

a second feedback loop from the second tap to control the fiber amplifier based on measurement of output from the first optical tap.

Applicants maintain that the combination of Price and Horvath fail to teach the combination of limitations recited in Claim 42 as amended. Nor would Claim 42 be obvious to one skilled in the art in possession of Price and Horvath. Applicants, therefore, respectfully request that the rejection of Claim 42 be withdrawn.

Claims 43 and 47-50 depend from Claim 42 and, thus, Claims 43 and 47-50 include all of the features of Claim 42. As described above, Claim 42 is patentable over the combination of Price and Horvath. Accordingly, the combination of claim limitations recited in Claims 43 and 47-50 are not taught or suggested by the combination of cited references for at least the reasons

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described above with regard to Claim 42. Applicants, therefore, respectfully request that Claims 43 and 47-50 be allowed.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants request that the Examiner withdraw the outstanding rejections and allow the present application.

By focusing on specific claims and claim limitations in the discussion above, Applicants do not imply that other claim limitations are disclosed or suggested by the references.

If any issues remain which can potentially be resolved by telephone, the Examiner is invited to call the undersigned attorney of record at the telephone number listed below.

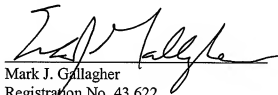
Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: 3/13/07

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